

Aplanospores may be liberated by a breaking of the mother-cell wall or only after its decay. They may germinate directly into new plants, or they may produce zoospores that develop into new plants.

**Sexual Reproduction.** The Chlorophyceae are an evolutionary series in which gametic union became firmly established in the most primitive forms and persists among the highest members of the series. Gametic union of many species is *isogamous* (Fig. 8B) and with a fusion of two flagellated or nonflagellated gametes of equal size. Other species are either *anisogamous* (Fig. 9E) and with a union of two flagellated gametes of unequal size or *oögamous* (Fig. 13B) and with a small motile male gamete (*antherozoid*) uniting with a large immobile gamete (*egg*). In at least four independent lines among the green algae, there has been an evolution from isogamy to oögamy.

Many Chlorophyceae show a marked seasonal periodicity in the occurrence of their sexual reproduction. In fresh-water algae this usually takes place late in the spring, but it may not take place until the fall. Sexual reproduction of *Spirogyra* seems to take place only when a certain amount of reserve food has accumulated. Here, the accumulation of a sufficient food reserve is directly dependent upon the ratio between surface of cell, volume of the cell, and the temperature.<sup>1</sup> The prevalent idea that a lowering of the water supply in a pool induces fruiting is incorrect, since it has been shown<sup>2</sup> that there is an even more abundant fruiting if weather conditions are such that the water level of a pool does not fall.

The production of flagellated gametes (*zoogametes*) is almost identical with that of zoospores. Gamete-producing cells, the *gametangia*, are generally morphologically indistinguishable from vegetative cells.

All green algae in which both gametes are nonflagellated (*aplano-gamous*) are isogamous. Aplanogamy is found throughout the Zygnematales and is a feature immediately separating them from other Chlorophyceae. Some Zygnematales are truly isogamous and with both gametes of a uniting pair amoeboid. Other Zygnematales, as *Spirogyra*, have the morphological isogamy accompanied by a physiological differentiation in which one gamete is passive and the other actively amoeboid.

In anisogamous species the larger gamete of the two is always considered the female. It may be but little larger than the male gamete (*Pandorina*, page 33), or it may be many times larger (*Codium*, page 113).

With one exception (*Sphaeroplea*, page 66), eggs of oögamous species are produced singly within a gametangium, the *oögonium*, morphologically different from vegetative cells. The *antheridium*, the game-

<sup>1</sup> Transeau, 1916.

<sup>2</sup> Transeau, 1913.